Section 4-3: Sample Spaces and Theoretical Probability

By the end of this lesson, you should be able to answer:

- How do you determine sample spaces using various methods?
- How do you find theoretical probabilities?

Where you might see this in the real world:

- Sports, food service, games, number theory

Define the following terms:

1. Event

2. Sample space

3. Tree diagram

4. Fundamental counting principle

5. Theoretical probability

When conducting experiments, you could be working at finding the probability of an event or outcome. We will do this by looking at the total possible outcomes, which is known as the sample space.

This may sound similar to the idea of experimental probability, and it is. We are still looking for the number of times an outcome we want comes up. And we still divide it by the total number of possible outcomes. However, the outcomes we got came from an experiment that we conducted, which means the outcomes aren't always the same. However, if two people flip a coin, the more flips they do, the closer they will be to getting the same results. This is called theoretical probability.

Theoretical probability is the way an experiment *should* turn out. Experimental probability is the way an experiment *actually* turns out. To find the theoretical probability, we need to consider what all of the possible outcomes could be.

Example 1: Matt Mitarnowski is making a sandwich, using a bread and a filling. He has three types of bread to choose from: wheat (W), rye (R), or pumpernickel (P). He also has six kinds of fillings: tuna (T), egg (E), shrimp (S), chicken (C), ham (H), or bologna (B). How many possible sandwich combinations are there?

We collected the information in Example 1 by making a set of ordered pairs. We listed the type of bread first, then listed each filling with the breads to create the ordered pairs. Another way we can organize the information is with a tree diagram. We list the parts of the event one at a time, starting with the first type of thing we are working with, then making a branch for each of the next things.

Example 2: Three coins (a penny, a nickel, and a dime) are tossed at the same time. What is the probability of getting heads on exactly two of the coins?

You could also use the formula for finding theoretical probability along with the counting principle.

P(E) =

Example 3: Fuzzy Jeff has 3 shirts (1 blue, 1 black, and 1 white) and 2 pairs of jeans (one blue and one black), which he likes to mix and match. If Jeff's outfit today is one of those shirts and one of those pairs of jeans, what is the probability that his shirt and jeans will be the same color?

Homework:

"Sometimes the questions are complicated and the answers are simple." - Dr. Seuss